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then from the similar triangles NMT and KOS we have the proportion

$$MT : SO :: MN : OK;$$

$\therefore MT \times OK = SO \times MN$. But $SO \times MN$ equals double the area OMN; $\therefore MT \times OK =$ equals double the area OMN.

From A the middle of EF let fall the perpendicular AO. Then from the similar triangles EYF and OAI we have

$$EP : AO :: EF : OI;$$

$\therefore EY \times OI = AO \times EF$. But $A\ O \times EF$ equals double the area EFO; $\therefore EY \times OI =$ equals double the area EFO.

Therefore $MNO : EFO :: MT \times KO : EY \times IO :: A : B$ (because MT and EY are between parallels and are therefore equal, and OK is to OI as A to B); $\therefore$ area $OMN = (A \div B) \times$ area OEF.

Through the middle of EF draw UAV paralell to OK and bisecting MN in V, and from A and V let fall the equal perpendiculars, AW and VZ, on the axis OK.

The solid generated by revolving the triangle OMN around the axis OK is represented by area $OMN \times \frac{4}{3}\pi . VZ$. Or, since $MNO = (A \div B) \times OEF$, and $OEF = EF \times \frac{1}{2} AO$, the solid is $\frac{2}{3}\pi . EF . AW . AO \times (A \div B)$.

From the similar triangles EYF and AWO we find $EF \times AW = HQ \times AO$; and by substituting this equivalent for $EF \times AW$ in the above expression we have $\frac{2}{3}\pi . AO^2 . HQ \times (A \div B)$. When the number of sides of the inscribed polygon is infinite, $AO = OD = B$, and hence the above expression for the solid generated by revolving the triangle MNO about the axis OK, is $\frac{2}{3}\pi . A . B \times HQ$. As this expression is true for all values of HQ it is true for their sum; hence, substituting for the several values of HQ their sum, $OB = B$, we get, for the solidity of half the prolate ellipsoid $\frac{2}{3}\pi A . B^2$. Hence the solidity of the prolate ellipsoid is $\frac{4}{3}\pi . A . B^2$.

In a manner precisely similar to the foregoing it may be shown that the solidlty of the oblate ellipsoid is $\frac{4}{3}\pi . A^2 . B$.

GENERAL SOLUTION OF THE PROBLEM OF ANY NUMBER OF BODIES.

BY R. J. ADCOCK, ROSEVILLE, ILL.

THE masses of any number of bodies being given, together with their positions and motions at any given time with reference to any three rectangular axes, to find their positions and motions at any other time.

Let k_1 = the mutual attraction between two units of mass at a unit's distance, $m_1, m_2, m_3, \ldots$ the given masses, (a_1, b_1, c_1), (a_2, b_2, c_2), $(a_3, b_3, c_3), \ldots$ their coordinates at the time $t = 0$, $(\alpha_1, \beta_1, \gamma_1)$, $(\alpha_2, \beta_2, \gamma_2)$, $(\alpha_3, \beta_3, \gamma_3), \ldots$ their initial axial velocities, (x_1, y_1, z_1), (x_2, y_2, z_2), $(x_3, y_3, z_3), \ldots$ their coordinates and (u_1, v_1, w_1), (u_2, v_2, w_2), $(u_3, v_3, w_3), \ldots$ their axial velocities at any other time t.

Let the initial distances between m_1 and m_2, between m_1 and m_3, &c., be $d_1, d_2, \ldots$ &c.; and the same for the time t be $\delta_1, \delta_2 \ldots$ &c. Then

$$d_1^2 = (a_1 - a_2)^2 + (b_1 - b_2)^2 + (b_1 - b_3)^2,$$

$$d_2^2 = (a_1 - a_3)^2 + (b_1 - b_3)^2 + (c_1 - c_3)^2,$$

$$\ldots \ldots \ldots \ldots$$

$$\delta_1^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2,$$

$$\delta_2^2 = (x_1 - x_3)^2 + (y_1 - y_3)^2 + (z_1 - z_3)^2,$$

$$\ldots \ldots \ldots \ldots$$

and the attractions between m_1 and m_2, m_1 and m_3, &c., are

$$\frac{k_1 m_1 m_2}{\delta_1^2}, \quad \frac{k_1 m_1 m_3}{\delta_2^2}, \ldots \text{\&c.}$$

The sums of the axial components of the attractions of each of the bodies for m_1, give the three equations of motion for m_1:

$$\frac{d^2 x_1}{dt^2} = -\frac{k_1(x_1 - x_2)m_2}{\delta_1^3} - \frac{k_1(x_1 - x_3)m_3}{\delta_2^3} - \text{\&c.}, \tag{1}$$

$$\frac{d^2 y_1}{dt^2} = -\frac{k_1(y_1 - y_2)m_2}{\delta_1^3} - \frac{k_1(y_1 - y_3)m_3}{\delta_2^3} - \text{\&c.}, \tag{2}$$

$$\frac{d^2 z_1}{dt^2} = -\frac{k_1(z_1 - z_2)m_2}{\delta_1^3} - \frac{k_1(z_1 - z_3)m_3}{\delta_2^3} - \text{\&c.} \tag{3}$$

Since every astronomical variable is a function of the same independent variable t, therefore by Maclaurin's theorem

$$x_1 = a_1 + u_1 t + \left(-\frac{k_1 m_2 (a_1 - a_2)}{d_1^3} - \frac{k_1 m_3 (a_1 - a_3)}{d_2^3} - \text{\&c.} \right) \frac{t^2}{1.2} + \text{\&c.}$$

$$y_1 = b_1 + v_1 t + \left(-\frac{k_1 m_2 (b_1 - b_2)}{d_1^3} - \frac{k_1 m_3 (b_1 - b_3)}{d_2^3} - \text{\&c.} \right) \frac{t^2}{1.2} + \text{\&c.},$$

$$z_2 = c_1 + w_1 t + \left(-\frac{k_1 m_2 (c_1 - c_2)}{d_1^3} - \frac{k_1 m_3 (c_1 - c_3)}{d_2^3} - \text{\&c.} \right) \frac{t^2}{1.2} + \text{\&c.}$$

In the same manner may the other variables, velocities, &c., be found in an approximating series according to the ascending powers of t with coefficients containing the initial constants.